

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 974

## HIGH VOLTAGE PROGRAMMABLE FREQUENCY STEP-DOWN CONVERTER

LT3844

### DESCRIPTION

Demonstration Circuit 974 is a 100kHz – 500kHz programmable frequency, high voltage, current-mode DC/DC step-down converter featuring the LT3844. The operating frequency can be synchronized up to 600kHz.

The board operates from a  $V_{in}$  range of 15V – 60V and outputs 12Vout @ 4.2A (50W). A soft-start feature controls the output voltage slew rate at start-up, reducing current surges and voltage overshoots. The Burst Mode of operation that improves the efficiency at light loads can be enabled with a jumper.

An Optional Boost Bias circuit is provided on the bottom side of the board for back-driving the LT3844 internal regulator from the output voltage. Customers might want to use this optional circuit with modified applications that have relatively high input voltages and low (~5V) output voltages. In such applications, the optional

circuit can increase the overall efficiency by reducing the power lost in the LT3844. The demonstration board has also been laid out with the option for a second switching MOSFET to facilitate higher output currents. The circuit design can be modified for a Boost converter configuration.

This board is suitable for a wide range of Industrial control and automotive applications.

Note: It's best to Ground the SYNC pin if the SYNC function is not being used.

**Design files for this circuit board are available. Call the LTC factory.**

**Table 1. Performance Summary ( $T_A = 25^\circ\text{C}$ )**

PARAMETER	CONDITION	VALUE
Vin Input Voltage Range		15V → 60Vin
Efficiency	48Vin, 0.1Aout	76.5%
	48Vin, 1.0Aout	79.5%
	48Vin, 4.2Aout	87.5%
Switching Frequency		100kHz – 600kHz..
Output Voltage	0 – 4.2Aout	12V
Vout_ripple_pp		~ 75mV

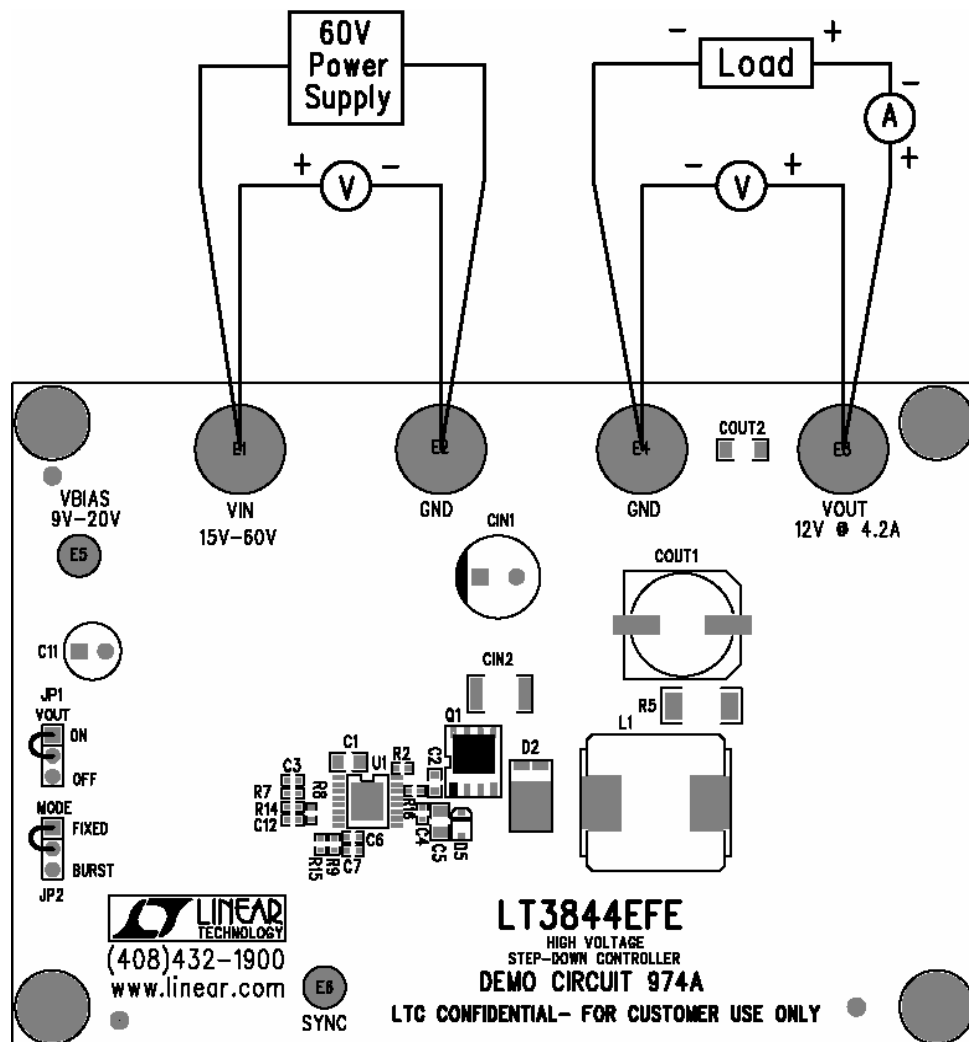
### QUICK START PROCEDURE

DC974 is easy to set up to evaluate the performance of the LT3844. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Apply a 0 – 4.2A Load across the Vout/Gnd turrets.
2. Connect Voltmeters and Ammeters as shown in Figure 1.
3. Connect a 0 - 60V Power Supply (or better) across the Vin/Gnd turrets. Typically it's best to set the Current Limit of this Power Supply to its maximum setting. The power supply must be capable of providing the required start-up power. If using a bench power supply, a 60V/15A rated (or better) supply is recommended. Set Vin to 15V – 60Vin for start-up. Make sure the SHDN/RUN jumper is in the RUN position.

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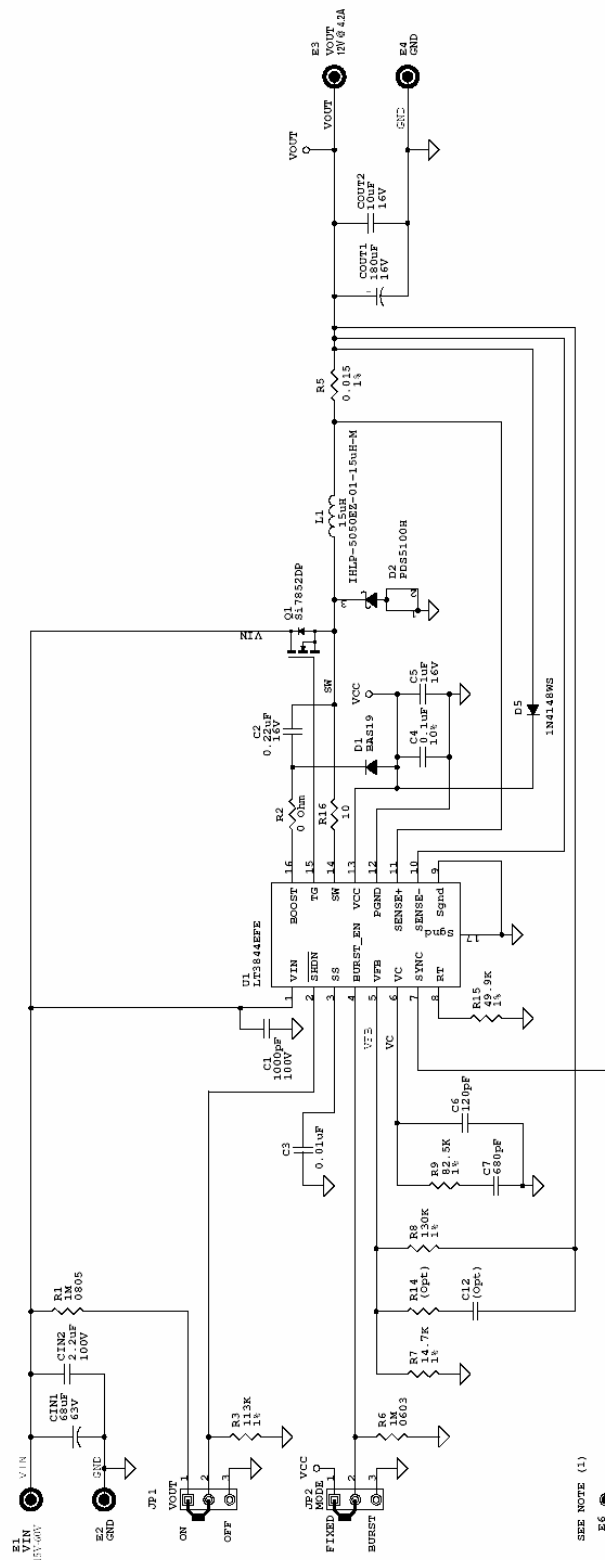
## HIGH VOLTAGE PROGRAMMABLE FREQUENCY STEP-DOWN CONVERTER





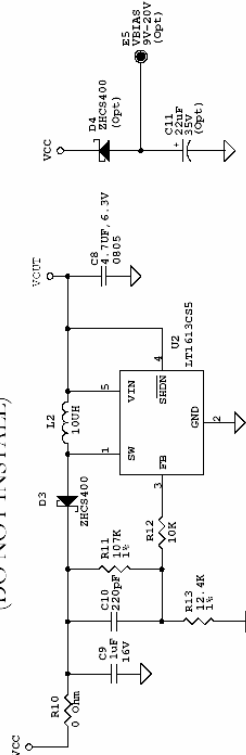
REVISION HISTORY				
ECO	REV	DESCRIPTION	DATE	APPROVED
	0	PROTOTYPE (774A 00 PCB 077A REV0 DGN)	05-08-05	.

**Customer Notice:** Linear Technology has made a best effort to design a circuit that meets customer-supplied specifications; however, it remains the customer's responsibility to verify proper and reliable operation in the actual application. Component substitution and printed circuit board layout may significantly affect circuit performance or reliability. Contact Linear Applications Engineering for assistance.



**NOTES: 1.** If the SYNC function is not being used tie the Sync pin to ground.

**OPTIONAL BOOST BIAS CIRCUIT**  
(DO NOT INSTALL)



UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE IN INCHES 2" X 4" = 1/2" X 3/4" = 3/8" X 1/2" = 1/4" X 3/8" = 1/8" X 1/4" = 1/16" X 1/8" = 1/32" X 1/16" = 1/64" X 1/32" = 1/512" X 1/256" = 1/128" X 1/64" = 1/32" X 1/16" = 1/8" X 1/4" = 1/2" X 1" = 1 1/2" X 2" = 2 1/2" X 3" = 3 1/2" X 4" = 4 1/2" X 5" = 5 1/2" X 6" = 6 1/2" X 7" = 7 1/2" X 8" = 8 1/2" X 9" = 9 1/2" X 10" = 10 1/2" X 11" = 11 1/2" X 12" = 12 1/2" X 13" = 13 1/2" X 14" = 14 1/2" X 15" = 15 1/2" X 16" = 16 1/2" X 17" = 17 1/2" X 18" = 18 1/2" X 19" = 19 1/2" X 20" = 20 1/2" X 21" = 21 1/2" X 22" = 22 1/2" X 23" = 23 1/2" X 24" = 24 1/2" X 25" = 25 1/2" X 26" = 26 1/2" X 27" = 27 1/2" X 28" = 28 1/2" X 29" = 29 1/2" X 30" = 30 1/2" X 31" = 31 1/2" X 32" = 32 1/2" X 33" = 33 1/2" X 34" = 34 1/2" X 35" = 35 1/2" X 36" = 36 1/2" X 37" = 37 1/2" X 38" = 38 1/2" X 39" = 39 1/2" X 40" = 40 1/2" X 41" = 41 1/2" X 42" = 42 1/2" X 43" = 43 1/2" X 44" = 44 1/2" X 45" = 45 1/2" X 46" = 46 1/2" X 47" = 47 1/2" X 48" = 48 1/2" X 49" = 49 1/2" X 50" = 50 1/2" X 51" = 51 1/2" X 52" = 52 1/2" X 53" = 53 1/2" X 54" = 54 1/2" X 55" = 55 1/2" X 56" = 56 1/2" X 57" = 57 1/2" X 58" = 58 1/2" X 59" = 59 1/2" X 60" = 60 1/2" X 61" = 61 1/2" X 62" = 62 1/2" X 63" = 63 1/2" X 64" = 64 1/2" X 65" = 65 1/2" X 66" = 66 1/2" X 67" = 67 1/2" X 68" = 68 1/2" X 69" = 69 1/2" X 70" = 70 1/2" X 71" = 71 1/2" X 72" = 72 1/2" X 73" = 73 1/2" X 74" = 74 1/2" X 75" = 75 1/2" X 76" = 76 1/2" X 77" = 77 1/2" X 78" = 78 1/2" X 79" = 79 1/2" X 80" = 80 1/2" X 81" = 81 1/2" X 82" = 82 1/2" X 83" = 83 1/2" X 84" = 84 1/2" X 85" = 85 1/2" X 86" = 86 1/2" X 87" = 87 1/2" X 88" = 88 1/2" X 89" = 89 1/2" X 90" = 90 1/2" X 91" = 91 1/2" X 92" = 92 1/2" X 93" = 93 1/2" X 94" = 94 1/2" X 95" = 95 1/2" X 96" = 96 1/2" X 97" = 97 1/2" X 98" = 98 1/2" X 99" = 99 1/2" X 100" = 100 1/2" X 101" = 101 1/2" X 102" = 102 1/2" X 103" = 103 1/2" X 104" = 104 1/2" X 105" = 105 1/2" X 106" = 106 1/2" X 107" = 107 1/2" X 108" = 108 1/2" X 109" = 109 1/2" X 110" = 110 1/2" X 111" = 111 1/2" X 112" = 112 1/2" X 113" = 113 1/2" X 114" = 114 1/2" X 115" = 115 1/2" X 116" = 116 1/2" X 117" = 117 1/2" X 118" = 118 1/2" X 119" = 119 1/2" X 120" = 120 1/2" X 121" = 121 1/2" X 122" = 122 1/2" X 123" = 123 1/2" X 124" = 124 1/2" X 125" = 125 1/2" X 126" = 126 1/2" X 127" = 127 1/2" X 128" = 128 1/2" X 129" = 129 1/2" X 130" = 130 1/2" X 131" = 131 1/2" X 132" = 132 1/2" X 133" = 133 1/2" X 134" = 134 1/2" X 135" = 135 1/2" X 136" = 136 1/2" X 137" = 137 1/2" X 138" = 138 1/2" X 139" = 139 1/2" X 140" = 140 1/2" X 141" = 141 1/2" X 142" = 142 1/2" X 143" = 143 1/2" X 144" = 144 1/2" X 145" = 145 1/2" X 146" = 146 1/2" X 147" = 147 1/2" X 148" = 148 1/2" X 149" = 149 1/2" X 150" = 150 1/2" X 151" = 151 1/2" X 152" = 152 1/2" X 153" = 153 1/2" X 154" = 154 1/2" X 155" = 155 1/2" X 156" = 156 1/2" X 157" = 157 1/2" X 158" = 158 1/2" X 159" = 159 1/2" X 160" = 160 1/2" X 161" = 161 1/2" X 162" = 162 1/2" X 163" = 163 1/2" X 164" = 164 1/2" X 165" = 165 1/2" X 166" = 166 1/2" X 167" = 167 1/2" X 168" = 168 1/2" X 169" = 169 1/2" X 170" = 170 1/2" X 171" = 171 1/2" X 172" = 172 1/2" X 173" = 173 1/2" X 174" = 174 1/2" X 175" = 175 1/2" X 176" = 176 1/2" X 177" = 177 1/2" X 178" = 178 1/2" X 179" = 179 1/2" X 180" = 180 1/2" X 181" = 181 1/2" X 182" = 182 1/2" X 183" = 183 1/2" X 184" = 184 1/2" X 185" = 185 1/2" X 186" = 186 1/2" X 187" = 187 1/2" X 188" = 188 1/2" X 189" = 189 1/2" X 190" = 190 1/2" X 191" = 191 1/2" X 192" = 192 1/2" X 193" = 193 1/2" X 194" = 194 1/2" X 195" = 195 1/2" X 196" = 196 1/2" X 197" = 197 1/2" X 198" = 198 1/2" X 199" = 199 1/2" X 200" = 200 1/2" X 201" = 201 1/2" X 202" = 202 1/2" X 203" = 203 1/2" X 204" = 204 1/2" X 205" = 205 1/2" X 206" = 206 1/2" X 207" = 207 1/2" X 208" = 208 1/2" X 209" = 209 1/2" X 210" = 210 1/2" X 211" = 211 1/2" X 212" = 212 1/2" X 213" = 213 1/2" X 214" = 214 1/2" X 215" = 215 1/2" X 216" = 216 1/2" X 217" = 217 1/2" X 218" = 218 1/2" X 219" = 219 1/2" X 220" = 220 1/2" X 221" = 221 1/2" X 222" = 222 1/2" X 223" = 223 1/2" X 224" = 224 1/2" X 225" = 225 1/2" X 226" = 226 1/2" X 227" = 227 1/2" X 228" = 228 1/2" X 229" = 229 1/2" X 230" = 230 1/2" X 231" = 231 1/2" X 232" = 232 1/2" X 233" = 233 1/2" X 234" = 234 1/2" X 235" = 235 1/2" X 236" = 236 1/2" X 237" = 237 1/2" X 238" = 238 1/2" X 239" = 239 1/2" X 240" = 240 1/2" X 241" = 241 1/2" X 242" = 242 1/2" X 243" = 243 1/2" X 244" = 244 1/2" X 245" = 245 1/2" X 246" = 246 1/2" X 247" = 247 1/2" X 248" = 248 1/2" X 249" = 249 1/2" X 250" = 250 1/2" X 251" = 251 1/2" X 252" = 252 1/2" X 253" = 253 1/2" X 254" = 254 1/2" X 255" = 255 1/2" X 256" = 256 1/2" X 257" = 257 1/2" X 258" = 258 1/2
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### REQUIRED CIRCUIT COMPONENTS:

Item	Qty	Reference	Part Description	Manufacturer / Part #
1	1	CIN1	Cap., Alum 68uF 63V 20%	SANYO 63ME68AX+TS
2	1	CIN2	Cap., X7R 2.2uF 100V 20%	TDK C4532X7R2A225M
3	1	COUT1	Cap., OSCON Alum 180uF 16V 20%	SANYO 16SVP180MX
4	1	COUT2	Cap., X5R 10uF 16V 20%	TDK C3216X5R1C106M
5	1	C1	Cap., NPO 1000pF 100V 10%	AVX 08051A102KAT1A
6	1	C2	Cap., X7R 0.22uF 16V 10%	TDK C1608X7R1C224K
7	1	C3	Cap., X7R 0.01uF 16V 10%	AVX 0402YC103KAT2A
8	1	C4	Cap., X5R 0.1uF 16V 10%	AVX 0402YD104KAT2A
9	1	C5	Cap., X7R 1uF 16V 10%	TDK C2012X7R1C105K
10	1	C6	Cap., X7R 120pF 25V 10%	AVX 04023C121KAT2A
11	1	C7	Cap., X7R 680pF 25V 10%	AVX 04023C681KAT2A
12	1	D1	Diode, Speed Switching	Diodes Inc. BAS19
13	1	D2	Schottky Diode 5A	Diodes Inc. PDS5100H
14	1	D5	Diode, 75V/200mW	Diodes Inc. 1N4148WS
15	1	L1	Inductor, 15uH	Vishay Dale IHL5050EZPJ150M01/ Vishay Dale IHL5050EZRZ150M01
16	1	Q1	Mosfet N-Chan., PowerPAK SO8	Vishay Siliconix Si7852DP
17	1	R1	Res., Chip 1M 0.1W 5%	AAC CR10-105M
18	1	R2	Res/Jumper, Chip 0 Ohm 0.06W 1 AMP	AAC CJ05-000M
19	1	R3	Res., Chip 113K 0.06W 1%	VISHAY CRCW04021133FRT6
20	1	R5	Res., LRC 0.015 0.5W 1%	IRC LRF2010-01-R015-F
21	1	R6	Res., Chip 1M 0.1W 5%	AAC CR16-105JM
22	1	R7	Res., Chip 14.7K 0.06W 1%	AAC, CR05-1472FM
23	1	R8	Res., Chip 130K 1/16W 1%	AAC CR05-1303FM
24	1	R9	Res., Chip 82.5K 0.06W 1%	AAC CR05-8252FM
25	1	R15	Res., Chip 49.9K 0.06W 1%	AAC CR05-4992FM
26	1	R16	Res., Chip 10.0 .06W 5%	AAC CR05-100JM
27	1	U1	I.C., Volt. Reg.	Linear Tech. Corp. LT3844EFE

### ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:

1	0	C8	Cap., X5R C-4.7uF,6.3V-0805 6.3V 20%	Taiyo Yuden JMK212BJ475MG-T
2	0	C9	Cap., X5R 1uF 16V 10%	Taiyo Yuden EMK212BJ105KG
3	0	C10	Cap., NPO 220pF 25V 10%	AVX 04023A221KAT2A
4	0	C11	Cap., Alum 22uF 35V 10%	SANYO 35MV22UAX
5	0	C12	Cap., 0402 TBD	
6	0	D3,D4	Schottky Diode, 40V	ZETEX ZHCS400
7	0	E5	Testpoint, Turret	Mill Max 2501-2
8	0	L2	Inductor, L-10UH	muRata LQH3C100M24
9	0	R10	Res/Jumper, Chip 0 Ohm 0.06W 1 AMP	AAC CJ05-000M
10	0	R11	Res., Chip 107K 0.06W 1%	AAC CR05-1073FM
11	0	R12	Res., Chip 10K 0.06W 5%	AAC CR05-103JM

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<i>Item</i>	<i>Qty</i>	<i>Reference</i>	<i>Part Description</i>	<i>Manufacturer / Part #</i>
12	0	R13	Res., Chip 12.4K 1/16W 1%	AAC CR05-1242FM
13	0	R14	Res., 0402 TBD	
14	0	U2	I.C., Volt. Reg.	Linear Tech. Corp. LT1613CS5
<b>HARDWARE-FOR DEMO BOARD ONLY:</b>				
1	4	E1,E2,E3,E4	Conn. Banana Jack	keystone 575-4
2	1	E6	Testpoint, Turret	Mill Max 2501-2
3	2	JP1,JP2	Headers, 3 Pins 2mm Ctrs.	CommConn Con Inc. 2802S-03G2
4	2	XJP2,XJP1	Shunt, 2mm Ctrs.	CommConn Con Inc. CCIJ2MM-138G
5	4	X1,X2,X3,X4	STAND-OFF 4-40 x1/2"	MICRO PLASTICS 14HTSP003
6	4		HWD, SCREW #4-40x1/4"	ANY
7	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT #974A
8	2		STENCIL	STENCIL 974A